PATENT SPECIFICATION

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812,313

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International Classification:—F02g. F03c. F06j.

COMPLETE SPECIFICATION

Fluid Pressure Motor

We, BENDIX AVIATION CORPORATION, of 401, North Bendix Drive, South Bend, Indiana, United States of America, a Corporation organized under the laws of the State of Delaware, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to fluid pressure motors, and more particularly to piston and cylinder arrangements having stop means which prevent the piston from being forced out of its cylinder by internal fluid pressure.

The present invention is intended to provide a new and improved fluid pressure motor of the piston and cylinder type utilizing ball bearing means to prevent the piston from being forced out of its cylinder and to guide the piston relative to the side walls of the cylinder.

According to the invention there is provided a fluid pressure motor comprising a cylinder body formed with a chamber reciprocably locating at least one end of a piston carrying a bearing including at least three circumferentially spaced ball bearings projecting radially outwardly of the surface of said piston, said chamber being longitudinally extending surfaces constructed and arranged to receive and guide said ball bearings upon longitudinal movement of said piston, characterized in that at least one of said ball bearings abuts against abutment means projecting radially inwardly from the side walls of said chamber at one end of said surfaces to limit movement of said piston.

The invention will now be described by way of example with reference to the accompanying drawings in which:—

Figure 1 is a longitudinal cross sectional view of one embodiment of the invention;

Figure 2 is a fragmentary longitudinal sectional view of a second embodiment of the invention;

Figure 3 is a cross sectional view taken on the line 3—3 of Figure 1;

Figure 4 is a cross sectional view taken on the line 4—4 of Figure 2;

Figure 5 is a longitudinal cross sectional view of another embodiment of the invention; and

Figure 6 is a fragmentary longitudinal sectional view of the embodiment of Figure 5, the piston being shown in abutment position.

The embodiment shown in Figure 1 generally comprises an open ended cylinder body A into which is inserted a piston member B, the opposite end portions of which contain suitable attachment means by which the piston and cylinder assembly may be connected between a stationary and a movable body.

The cylinder body A may be made in one or more pieces and as shown in Figure 1 is made in three sections, the first section being a generally tubular open end body 10 having a longitudinally extending bore 12 adapted to slidingly receive and guide the piston B. The opposite end portion of the cylinder A is formed by an end closure member 14 having a centrally located chamber 16 therein and a tapped passageway 18 communicating the chamber 16 with the external surface of the end closure member 14 and adapted to receive a piping connection from a pressure system. The end closure member 14 has two stepped counterbores 20 and 22, such that the two enlarged cylindrical surfaces are provided, each terminating in a shoulder. One end of a tube 24, having an internal diameter a predetermined amount greater than the diameter of piston B, is sweated into counterbore 20 with its end abutting shoulder 26 and the opposite end of the tube 24 is sweated into a similar counterbore 28 in the adjacent end of tubular body 10. Counterbore 22 in end closure member 14 is of a diameter equal to that of the internal diameter of tube 24 so as to provide a cylin-

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drical surface of constant diameter for a reason which will later be described.

The piston member B is adapted to extend into the cylinder A and may also be made in one piece, but as shown is conveniently made from a tubular member 30 and an outer end piston closure member 32. The piston closure member 32 has an axially extending boss on one of its ends which is sweated into the outer end of the tubular member 30 of the piston B, and the opposite end of which piston closure member is provided with a hole 34 by which it may be bolted to a movable object.

The inner end of the piston B of the embodiment shown in Figure 1 is provided with an annular socket or groove 36 adapted to retain a plurality of ball bearings 38, such that the outer portions of the balls contact and roll along the inside surface of the tube 24 and counterbore 22 previously indicated to be of the same diameter. In the embodiment shown in the drawing the cylinder end closure member 14 is provided with a tapped hole or opening 40 through which the ball bearings 38 may be fed to the annular groove or socket 36 of the piston, and a threaded plug 42 is screwed into the opening 40 to prevent escape of the ball bearings. The escape of fluid past the piston is prevented by an O-ring 44 seated in an annular groove 46 adjacent the outer end of open end body 10, such that fluid pressure entering passageway 18 forces the piston B outwardly of the cylinder A. End closure member 14 is provided with a hole 48 whereby it is adapted to be pivotally connected to a stationary member. Fluid pressure entering through passageway 18 causes the piston B to be moved outwardly. The ball bearings 38 during such movement are retained in the groove 36 and the piston is prevented from being forced out of the cylinder A upon the ball bearings 38 contacting the shoulder 50.

Figures 2 and 4

Figures 2 and 4 illustrate a second embodiment of the invention in which a plurality of individual ball bearing sockets 60 (in the present instance 3) are provided in the inner end of the piston B. The unit is otherwise quite similar to the preceding embodiment and the ball bearings 38 may be fed to the sockets in the same manner described for the preceding embodiment. The individual recesses or sockets 60 will preferably be spaced round the circumference of that cross-section of the piston that contains them, so that, when the unit is installed and the piston is in its innermost position, none of the recesses will be adjacent the screw plug 42.

Figures 5 and 6

The embodiment shown in Figures 5 and 6 comprises a cylinder A made from a piece of tubular material 52 having an annular end closure member 54 through which piston 56 extends and an opposite end closure member 58, both of which are welded in place. The piston 56 is made from a piece of cylindrical rod and is provided with an annular groove 60 adapted to receive the ball bearings 62. An annular fluid pressure seal 64 of U-shaped cross section is seated in a counterbore 66 in the outer end of the cylinder to effect a seal with respect to the piston 56, and the seal 64 is held in place by an annular back-up washer 68 retained by a snap ring 70. A dirt seal or wiper ring 72 is positioned in the outer end of the counterbore 66 to keep dirt out of the fluid pressure seal 64.

Prior to assembly of the unit shown in the drawings, the tube 52 is placed in a die and an inwardly extending projection or stop 74 is rolled into the metal. The unit is assembled by first attaching the annular end closure member 54 to one end of the tube 52. The piston is then inserted through the tube and closure member until its upper end projects out of the closure member 54, whereupon the ball bearings 62 are fed to the groove 60. The piston 56 is then retracted into the tube 52 and the opposite end closure member 54 is then welded in place. The opposite end closure member 54 and the projecting end of the piston 56 are provided with attachment holes 48 and 34 respectively, and the closure member 58 is provided with a tapped fluid pressure connection 76.

Operation of the above described device is believed to be obvious from the above description and attached drawings. Suffice it to say that the ball bearings 62 roll along the inside of tube 52 until they abut the crimped or stop portion 74 of the side walls of the tube.

While the preferred embodiments of the invention have been described as utilizing a cylinder chamber having a cylindrical surface adapted to confine the ball bearing means of the piston, it is not so limited. Where for example spaced individual sockets are utilized to support the individual ball bearings, a longitudinally extending groove in the cylinder wall may be provided for each of the ball bearings such that rotation of the piston relative to the cylinder may be controlled, and indeed may be prevented, depending upon whether the grooves are straight or helically formed. Methods other than that described for feeding the ball bearings to the sockets may also be utilized, as for example by the use of a threaded connection between the cylinder end closure member and the remainder of the cylinder, which connection may be uncoupled to permit the balls to be placed in the sockets of the piston and the cylinder end closure member to be thereafter screwed into place.

WHAT WE CLAIM IS:—

1. A fluid pressure motor comprising a

cylinder body formed with a chamber reciprocably locating at least one end of a piston carrying a bearing including at least three circumferentially spaced ball bearings projecting radially outwardly of the surface of said piston, said chamber having longitudinally extending surfaces constructed and arranged to receive and guide said ball bearings upon longitudinal movement of said piston, characterized in that at least one of said ball bearings abuts against abutment means projecting radially inwardly from the side walls of said chamber at one end of said surfaces to limit movement of said piston.

2. A fluid pressure motor according to Claim 1, characterized by a longitudinally extending chamber of a first predetermined diameter adjacent its closed end and of a smaller predetermined diameter adjacent its open end, said abutment means being provided by the diameter restriction of said chamber.

3. A fluid pressure motor according to Claim 1 or 2, characterized in that said bearing comprises a plurality of balls each seated in one individual socket formed in said piston.

4. A fluid pressure motor according to Claim 1 or 2, wherein said bearing includes balls seated adjacent each other in one circumferentially extending recess of said piston.

5. A fluid pressure motor according to Claim 1, 2, 3 or 4, characterized by a tapped hole radially extending through said body for introducing said balls.

6. A fluid pressure motor according to Claim 1, characterized in that said abutment means is formed by a radially inward deformation of the side wall of a tubular member constituting said body.

7. A fluid pressure motor substantially as illustrated and as described with reference to the accompanying drawings.

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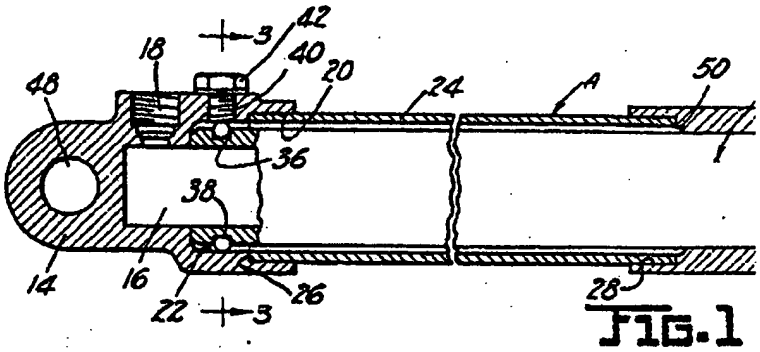


FIG. 1

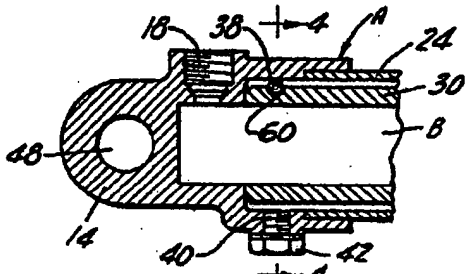
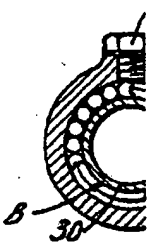


FIG. 2



FIG

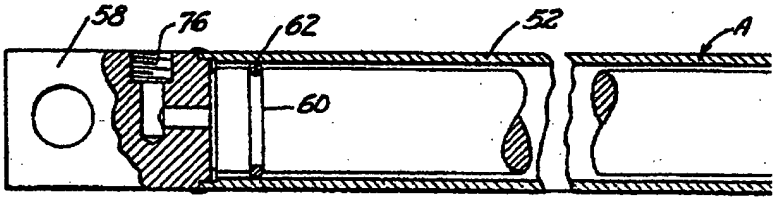


FIG. 5

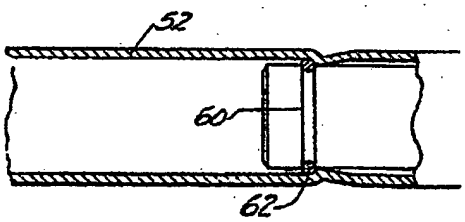


FIG. 6

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1 SHEET

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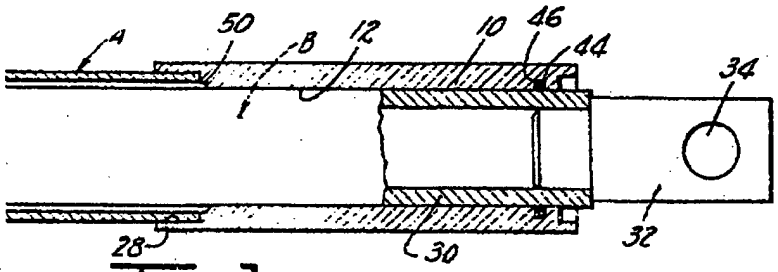

FIG. 1

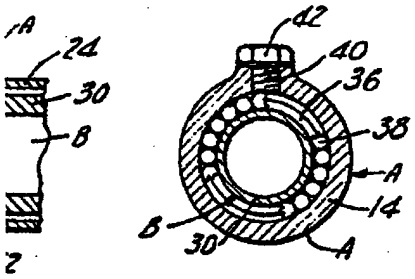

FIG. 3

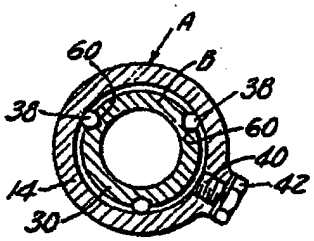

FIG. 4

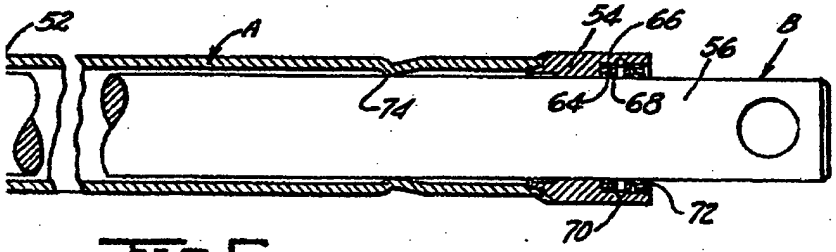

FIG. 5

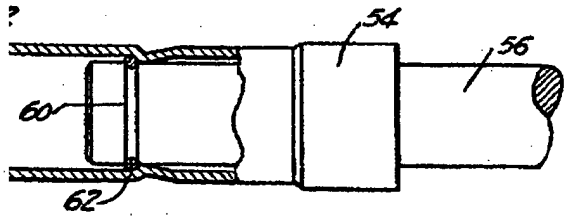

FIG. 6

812,313 COMPLETE SPECIFICATION
1 SHEET This drawing is a reproduction of the Original on a reduced scale.

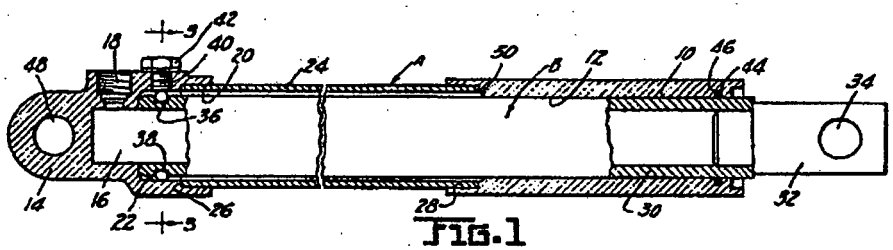

FIG.1

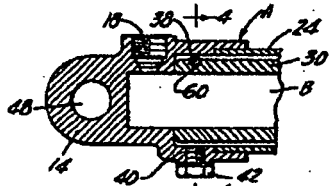

FIG.2

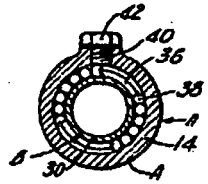

FIG.3

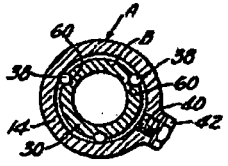

FIG.4

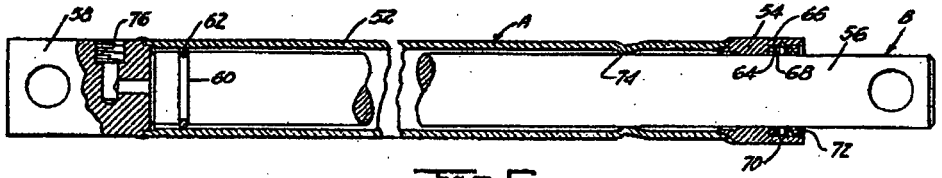

FIG.5

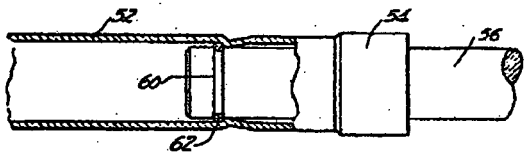

FIG.6